METHOD AND APPARATUS FOR DATA TRANSFER

FIELD OF THE INVENTION

The present invention relates generally to data transfer, and more specifically to managing the transfer of data to and from an entity.

BACKGROUND OF THE INVENTION

There is a need to communicate ever increasing amounts of information to and from entities such as, for instance, cars, trucks, helicopters, boats, etc., in support of new applications. An example of one such application is in-car digital video archiving, wherein large amounts of data, for instance several gigabytes, must be uploaded from a vehicle (or one or more devices in the vehicle) to one or more data repositories on a regular basis. Other applications may require the ability to download large amounts of information to the vehicle, for instance, to update maps or databases.

In the above example of in-car digital video archiving, there is a known method for uploading video data from, for instance, a public safety vehicle to one or more data repositories. In accordance with this process, a public safety official manually removes a video archiving device from the vehicle and physically connects it to a data repository for data upload on a dedicated communications link. These data repositories are normally housed in some central location, such as a local police station.

A drawback of this method of transferring the video data is that it can only be done when the vehicle's video archiving device and the data repository are in the same physical location. An additional drawback of this process is that it requires the video archiving device to be physically removed from the vehicle. This subjects the video archiving device and its electrical connectors to mechanical stress, thus decreasing the operational lifetime of the device.

In the above example, a physical connection and a dedicated communications link is used for the data transfer. However, it is feasible that

various wireless Local Area Network (WLAN) technologies could also be used to support the transfer of large amounts of data to and from vehicles. For instance, there may be a data transfer when the vehicle is in a physical location that is near a data repository. This process does not require the officer to remove the archiving device from the vehicle. Nor does it require a dedicated communications link. However, data transfer using a WLAN technology does require the vehicle to be within communication range of a data repository. In practice, vehicles may not be within range at either optimal times to reduce wireless contention or for long enough periods of time to complete the data transfers. Furthermore, because WLAN access points are typically shared by multiple clients, throughput (and ultimately transfer speed) likely cannot compete with a dedicated, exclusive link.

Thus, there exists a need for a method and apparatus: to enable the transfer of data to or from a vehicle during a time in which the vehicle is in a known physical location for a predictable time period; to provide a high bandwidth data transfer methodology that is easily implemented; and to optionally provide appropriate feedback to an operator to facilitate completion of the data transfer.

BRIEF DESCRIPTION OF THE FIGURES

A preferred embodiment of the invention is now described, by way of example only, with reference to the accompanying figures in which:

FIG. 1 illustrates a simple block diagram of a system for data transfer in accordance with an embodiment the present invention;

FIG. 2 illustrates a system for data transfer to or from a vehicle while it is being refueled, in accordance with an embodiment of the present invention;

FIG. 3 illustrates a flow diagram of a method for data transfer in accordance with an embodiment of the present invention;

FIG. 4 illustrates apparatus for establishing a data communications link with a vehicle during refueling, in accordance with an embodiment of the present invention

FIG. 5 illustrates a simple block diagram of a system for data transfer in accordance with another embodiment the present invention;

FIG. 6 illustrates a system for data transfer to or from a vehicle while it is being refueled, in accordance with another embodiment of the present invention; and

FIG. 7 illustrates a simple block diagram of a system for data transfer in accordance with another embodiment the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

While this invention is susceptible of embodiments in many different forms, there are shown in the figures and will herein be described in detail specific embodiments, with the understanding that the present disclosure is to be considered as an example of the principles of the invention and not intended to limit the invention to the specific embodiments shown and described. Further, the terms and words used herein are not to be considered limiting, but rather merely descriptive. It will also be appreciated that for simplicity and clarity of illustration, elements shown in the figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to each other. Further, where considered appropriate, reference numerals have been repeated among the figures to indicate corresponding elements.

The present invention provides a method and apparatus for data transfer to and from a vehicle as a function of a primary service function being performed on the vehicle. It should also be understood that data transfer to and from a vehicle includes data transfer to and from one or more devices in, coupled to, or incorporated into the vehicle. Usually the primary service function would be performed periodically, and likely during regular and predictable intervals, so that the data transfer to or from the vehicle would be performed during regular and periodic intervals. Moreover, the primary service function may be, for instance but not limited to, the refueling of a vehicle, cleaning the interior or exterior of a vehicle, performing an oil change on a vehicle, heating a vehicle's engine, for

instance during off-hours, in cold environments, or loading and unloading cargo from a vehicle. As will be shown in detail below, one of the benefits of the present invention is that the transfer of data to or from a vehicle is enabled during a time in which the vehicle is in a known physical location for a predictable period of time.

FIG. 1 illustrates a simple block diagram of a system 100 for data transfer in accordance with an embodiment of the present invention. System 100 includes a communications network element 110, which may be a server or that may comprise one or more servers and additional network connectivity elements such as routers, etc., that resides on a fixed network infrastructure and that is coupled to one or more data repositories (not shown), a data communications controller 120, a first communications element 130 that is coupled to a system for performing a primary service function on a vehicle, and a second communications element 140 that is coupled to the vehicle. The data communications controller 120 manages the transfer of data between the vehicle and one or more data repositories. In the embodiment illustrated in FIG. 1, the data communications controller 120 resides on the fixed infrastructure of the communications network common to the one or more data repositories.

Data transfer to and from the vehicle is enabled using system 100 as follows. Upon detection of the initiation of a primary service function, a communications link 150 is established that enables the transfer of data to or from the vehicle. Communications link 150 may be established, for instance, as a function of the operative coupling of the first communications element 130 that is coupled to the primary service function system and the second communications element 140 that is coupled to the vehicle. The data communications controller 120 then manages the transfer of data from the vehicle to communications network element 110, and ultimately to a data repository via the established communications link 150. In the same manner, data may be transferred from the data repository to the vehicle via the established communications link 150. Then upon the termination of the service function and, correspondingly, the

communications link 150, or alternatively, upon the completion of the transfer of a predetermined amount of data, the data communications controller 120 manages the termination of the data transfer.

FIG. 2 illustrates a system 200 for data transfer to or from a vehicle in accordance with an embodiment of the present invention. In this embodiment, the primary service function being performed on the vehicle is refueling. However, those of ordinary skill in the art will realize that system 100 can be modified for implementation with other service functions including, but not limited to, those listed above. System 200 includes a communications network element 240 that resides on a fixed network infrastructure and that is coupled to one or more data repositories, a data communications controller 230, a first communications element (not shown) that may be coupled to a fuel delivery nozzle 224 (also referred to herein as a fuel nozzle and that may include, but is not limited to a nozzle portion, a handle, a fuel release lever, and a hose) of a refueling system 220, and a second communications element (not shown) that may be coupled to a vehicle 210. The functionality of the elements of system 200 will be described below by reference to the flow diagram illustrated in FIG. 3.

FIG. 3 illustrates a flow diagram of a method for data transfer in accordance with an embodiment of the present invention. According to the present invention, the data transfer between the vehicle and one or more data repositories is managed as a function of at least one action taken during a primary service function being performed on the vehicle. For the sake of clarity, this flow diagram will be described by reference to system 200 in FIG. 2, wherein vehicle refueling is the primary service function. Refueling refers to any type of fuel, including, but not limited to, hydrocarbon-based fuels such as gasoline, diesel, natural gas, hydrogen and electricity. However, this description is in no way intended to limit the applicability of the invention to refueling. Those of ordinary skill in the art will realize that the method illustrated by the flow diagram of FIG. 3 may be implemented in accordance with additional embodiments including, but

not limited to, embodiments wherein the primary service function is one of those listed above.

Accordingly, where the primary service function is refueling, the initiation and transfer of data between the vehicle and one or more data repositories and the termination of the data transfer may be controlled as a function of at least one action taken during the refueling process. These actions may include, but are not limited to: authorizing a refueling transaction; providing a means of payment; removing the fuel nozzle from a pump cradle; inserting the fuel nozzle into the vehicle's filler neck (also referred to herein as a fuel receptacle); activating a fuel release lever; monitoring the fuel delivery; releasing the fuel release lever; removing the fuel nozzle from the vehicle's filler neck; or returning the fuel nozzle into the pump cradle.

Returning to the detailed description of the flow diagram illustrated in FIG. 3, the first step is detecting the initiation of a primary service function being performed on the vehicle. In the present example, wherein the primary service function is refueling, the signal may be generated as a function of, for instance, an operator of a fuel pump squeezing the fuel release lever or as a function of fuel flowing into the vehicle. This signal may be detected within the refueling system 220 using known processes and communicated to the data communications controller 230 using a predefined protocol and conventional communications means known in the art such as short range wireless technologies or via a physical connection. In an alternative embodiment, a signal may be generated by the first communications element, e.g., 130, upon its activation, or more likely generated by the second communications element, e.g., 140, upon its activation, wherein the data communications controller 230 may sense this signal using conventional means known in the art.

Once the initiation of the primary service function is detected, a communications link may be established with the vehicle or a communications device that is coupled to the vehicle. This step may include, for instance, identifying the vehicle being serviced, authenticating the vehicle's identity,

authorizing a data transfer between the vehicle and one or more data repositories, determining the amount of data to be transferred, and setting up the communications link.

The vehicle identification information may be used to authenticate the vehicle, to authorize the data transfer transaction, or to determine a network address for one or more in-car communication devices to enable the data transfer. The vehicle identification information may also be used by the primary service function system, for instance, the refueling system 220, for purposes of billing and accounting related to the primary service function. In one embodiment, the network address and other parameters such as, for instance, vehicle identification number, vehicle license plate number, vehicle asset number, vehicular device capabilities, or current operator identification, may be stored with the vehicle identification information. Moreover, the vehicle identification information may be used in conjunction with an administrative database to maintain authentication, authorization, and network device information. This database may also be configured to indicate the type of data transfer transactions permitted, e.g., video upload, application download, etc.

In one embodiment of the present invention, wherein the primary service function is refueling, the fuel delivery nozzle may be equipped with a mechanism to uniquely identify the vehicle being refueled. For instance, when the fuel nozzle is inserted into the vehicle's filler neck, a mechanism associated with the nozzle may read the vehicle identification. The vehicle identification may, for instance, be in the form of physical markings, such as a bar code. The vehicle may also be identified via, for instance, a passive component such as a radio frequency identification (RFID) tag, or an active component such as a radio, an ultrasonic transmitter or a conduction transponder, wherein the vehicle's identification information may be readable by, for instance, a conventional device coupled to or embedded in the fuel nozzle.

In an alternate embodiment, authorization and accounting information may be provided by the operator into a fuel pump to identify the vehicle. These means

may include, for instance, swiping a credit card, turning a key, utilizing a smart card technology, scanning an employee badge, or other conventional means known in the art.

In yet another embodiment, the vehicle's identification information may be stored within a network device inside the vehicle. The authorization and accounting transaction may then be conducted in a conventional manner solely within the confines of the communication link between the vehicle based network device and the second communications element 140. Moreover, this authorization and accounting transaction may, for instance, be initiated based upon the detection that the fueling process has been initiated.

The actual data communications link between the vehicle and devices in the infrastructure may be accomplished using a variety of means such as, for instance, short range wireless technologies, optical technologies, and physical connections. It will also be realized that establishing a communications link with the vehicle may also include establishing a communications link with one or more communications devices, housed in, coupled to, or integrated within the vehicle. Various embodiments of establishing the actual communications link with the vehicle during refueling will be later described by reference to the communications apparatus illustrated in FIG. 4.

Returning again to the detailed description of the flow diagram illustrated in FIG. 3, the step of establishing the communications link may also include, for instance, the data communications controller 230 determining an amount of data to be transferred. For instance, the data communications controller 230 may retrieve information from the infrastructure, e.g., a data repository, regarding the amount of information to be downloaded to the vehicle. The data communications controller 230 may then estimate the amount of time needed to complete the primary service function, for instance using one or more devices located on the fuel pump or the vehicle, and may then use this information to determine the amount of data to be downloaded such that the data transfer may be completed prior to the completion of the primary service function. Alternatively,

the data communications controller 230 may communicate with at least one device onboard the vehicle, once a communications link has been established with the vehicle, and, by this means, determine the amount of information to be uploaded from the vehicle. The data communications controller may alternatively be configured to estimate the amount of information to be uploaded from the vehicle, for instance, as a function of determining the amount of time that has elapsed since the last upload from a given vehicle.

Once the communications link is established, the data transfer may commence between the vehicle and one or more data repositories via the established communications link. In one embodiment, when the fuel transfer begins, the data communication controller 230 may, for instance, initiate the data transfer with one or more devices in the vehicle as indicated by information retrieved from a database connected to the network infrastructure. The data communications controller 230 may then manage the data transfer until either the communications link is disrupted, for instance by the completion of the primary service function, or until the data transfer is completed.

The data transfer may optionally be paced with the primary service function using a variety of means. In one embodiment, the refueling system may provide an audible, visual or other type of indication when the refueling and data transfer tasks are started and when they are completed. For instance, a display associated with the fuel nozzle or the fuel pump may give an indication of the upload or download progress. This progress may be indicated in a variety of ways, including, but not limited to, an expected time to completion display, a progress bar display, or similar means. Other status and progress information such as, for instance, file names, video clip date/time markers, etc., may also be displayed. The operator may then initiate the refueling and, thereby, the data transfer, and disrupt the communications link by terminating the refueling process only after receiving an indication that both the refueling and the data transfer are complete.

In another embodiment, the automated completion of the flow of fuel into the vehicle, the releasing of the fuel release lever or the removal of the fuel nozzle from the vehicle's fuel receptacle may be a warning of impending loss of communication ability. The data communications controller 230 may use the warning to stop the data transfer at a known point or to warn the operator by audible or visual or other means of an incomplete data transfer such as to cause the operator to leave the fuel nozzle in the fuel receptacle until the data transfer is complete. In still another embodiment, the automated completion of the flow of fuel into the vehicle, the releasing of the fuel release lever or the removal of the fuel nozzle from the vehicle's fuel receptacle may be a command to the data communications controller 230 to immediately terminate the data transfer.

FIG. 4 illustrates a schematic diagram of apparatus for establishing a data communications link with a vehicle, wherein the primary service function is refueling. This communications apparatus includes a first communications element 414 coupled to a fuel nozzle 404. FIG. 4 illustrates communications element 414 being coupled to a nozzle portion 412 of fuel nozzle 404. However, those of ordinary skill in the art will realize that in other embodiments, communications element 414 may be coupled or incorporated within other areas of a fuel pump (not shown) or the fuel nozzle 404, including in a fuel hose 418, a handle 410, or a fuel release lever 416. The communications apparatus further includes a second communications element 434 coupled to a vehicle 420. FIG. 4 illustrates the communications element 434 being coupled to a fuel receptacle 430 of the vehicle 420, but those of ordinary skill in the art will realize that the communications element 434 may be coupled to or incorporated within other areas of the vehicle 420.

Various embodiments of establishing the actual communications link with the vehicle during refueling will now be described by reference to the communications apparatus illustrated in FIG. 4. The communications link enables data to be uploaded from or downloaded to the vehicle or a device therein and is

established, for instance, upon communications element 414 and communications element 434 being operatively aligned or operatively coupled together.

In a first embodiment, the communications link with the vehicle is established as a function of an electrical connection being made between the communication element 414 in the nozzle portion 412 and the communications element 434 in the vehicle's fuel receptacle 430. Communications element 414 may include one or more conductive leads, and communications element 434 may include one or more conducting surfaces. Alternatively, communications element 434 may include one or more conductive leads, and communications element 414 may include one or more conducting surfaces. The electrical connection is formed when the conducting leads make contact with the conducting surfaces. Various mechanical methods known in the art may be used, for instance, to automatically line up the conductive leads with the conducting surfaces. Moreover, the communications element 414 is illustrated in FIG. 4 as being connected to the nozzle portion 412 of the fuel nozzle 404. However, those of ordinary skill in the art will realize that communications element 414 may also be coupled to other parts of fuel nozzle 404 including, but not limited to, a vapor recovery housing (not shown in FIG. 4).

In an alternate embodiment, the communications link with the vehicle is established as a function of an electrical field coupling being made between the communication element 414 in the fuel nozzle 404 and the communications element 434 in the vehicle's fuel receptacle 430. Communications element 414 may include one or more wireless devices and communications element 434 may include one or more wireless devices. For instance, communications elements 414 and 434 may each comprise one or more antennas. In one configuration, a strip line antenna may be incorporated into the fuel nozzle 404 such as by being molded into the vapor recovery housing and one or more antennas may placed around the vehicle's fuel receptacle 430 to eliminate the need to precisely place the fuel nozzle into the filler neck. The antennas coupled to the fuel nozzle 404

and those couple to the vehicle 420 may then each be coupled to respective low power radios that include a transmitter and a receiver.

Each radio may be collocated with its corresponding antenna or antennas. Alternatively, each radio may be located elsewhere within the refueling system and the vehicle and cabled to the respective antennas. In one embodiment, each radio is a microwatt-level 16-GHz radio that provides a 1 GB/s data link. In another embodiment, each radio is a communications entity utilizing WLAN radio transmission technology. Those of ordinary skill in the art will realize that other types of radios, other power levels and other frequencies could be utilized. The wireless communications link may be used as part of a 1000Base-T Ethernet network, for instance, by coupling the radio associated with communications element 414 to the data communications controller 230. The resulting system would provide a very high-speed contactless interconnect that is compatible with standard data networking technology.

The wireless devices described by reference to the above embodiment were antennas. However, those of ordinary skill in the art will realize that communications elements 414 and 434 may comprise wireless devices that may take other forms known in the art. For instance, communications elements 414 and 434 may each be configured as a plate of a capacitor and the communications link established as a function of the capacitive coupling of communications elements 414 and 434. Alternatively, the communications link may be established as a function of the inductive coupling of communications elements 414 and 434.

In yet another embodiment, the communications link with the vehicle is established as a function of an optical coupling being made between the communication element 414 in the nozzle portion 412 and the communications element 434 in the vehicle's fuel receptacle 430. Communications elements 414 and 434 may include one or more optical devices such as, for instance, optical emitters and detectors that when operatively coupled facilitate the communications link between the devices on board the vehicle and the devices on the infrastructure. In one embodiment, the emitters and detectors 414 may, for

instance, may be arranged in a straight line on the nozzle portion 412 in the direction of insertion of the nozzle portion into vehicle's fuel receptacle 430. Correspondingly on the vehicle, the optical emitters and detectors 434 may be, for instance, arranged perpendicular to the direction of insertion of the fuel nozzle 412 into the vehicle's fuel receptacle 430, such as by being circumferentially mounted on the vehicle's fuel receptacle 430. Alternatively, the emitters and detectors 434 may, for instance, may be arranged in a straight line on the vehicle's fuel receptacle 430 in the direction of insertion of the nozzle portion 412 into vehicle's fuel receptacle. Correspondingly on the fueling system, the optical emitters and detectors 414 may be, for instance, arranged perpendicular to the direction of insertion of the nozzle portion 412 into the vehicle's fuel receptacle 430, such as by being circumferentially mounted on the nozzle portion 412. When the nozzle portion 412 is inserted into the vehicle's fuel receptacle 430, optical coupling is formed where the straight line emitters and detectors are in close proximity with the circumferentially-mounted emitters and detectors. Base-band or modulated signaling may be used. Infrared, visible or ultraviolet light emitters and detectors may, alternatively, be used. The optical devices may, thereby, provide a 1 GB/s data link that may, for instance, be used as part of a 1000Base-T Ethernet link.

Those skilled in the art will realize that, in an alternative WLAN embodiment, the location of the WLAN radios and associated directional antennas may not necessarily be coupled to the refueling system and the vehicle as indicated in FIG. 4, but may be coupled in alternative ways. For instance, communications element 414 may be mounted to an area above the refueling system, and communication element 434 may be mounted on the roof of the vehicle. Moreover, the WLAN radio associated with the refueling system may be cabled to the data communications controller 230 via a suitably fast wired connection, such as a 100Base-T or a 1000Base-T Ethernet link. In this instance, the data communications controller 230 may be connected to the communications network element 240.

FIG. 5 illustrates a simple block diagram of a system 100 for data transfer in accordance with an alternative WLAN embodiment such as the one described in the previous paragraph. System 100 of FIG. 5 includes elements that are similar to those elements that comprise system 100 in FIG. 1. However the connectivity between the elements illustrated in FIG. 5 and their associated functionality is slightly different from the connectivity and the associated functionality of the elements illustrated in FIG. 1. System 100 of FIG. 5 may include a communications network element 110 that resides on a fixed network infrastructure and that is coupled to one or more data repositories (not shown), a data communications controller 120, a first communications element 130 that is coupled to a system for performing a primary service function on a vehicle, a second communications element 140 that is coupled to the vehicle, and a WLAN device 160 such as a WLAN access point that may be, for instance, coupled in a conventional fashion to the primary service function system or, alternatively to an area sufficiently close to the primary service function system. The data communications controller 120 manages the transfer of data between the vehicle and one or more data repositories. In the embodiment illustrated in FIG. 5, the data communications controller 120 resides on the fixed infrastructure of the communications network common to the one or more data repositories.

Data transfer to and from the vehicle is enabled using system 100 as follows. Upon detection of the initiation of a primary service function, a communications link is established via the WLAN device 160, which enables the transfer of data to or from the vehicle. The initiation of the primary service function may be communicated, for instance, via the first communications element 130 coupled to the primary service function system. The data communications controller 120 may then manage the transfer of data from the vehicle to communications network element 110, and ultimately to a data repository via the established communications link. In the same manner, data may be transferred from the data repository to the vehicle via the established communications link. Then upon the termination of the service function and,

correspondingly, the communications link, or alternatively, upon the completion of the transfer of a predetermined amount of data, the data communications controller 120 manages the termination of the data transfer. Those of ordinary skill in the art will realize that the method for data transfer in accordance with the embodiment of the invention illustrated in the flow diagram illustrated in FIG. 3 can be performed by the system 100 illustrated in FIG. 5.

In accordance with this WLAN embodiment, when the vehicle is within a close and predictable distance, for instance limited by the length of the hose 418, and at a predictable orientation, for instance based on the vehicle's fuel receptacle 430, the WLAN can be optimized to use short-range transmissions and directional antennas to reduce interference and contention from other nearby vehicles or refueling stations when transferring data to or from the vehicle via the WLAN radios. Such contention issues may be a significant problem with a high-density of WLAN nodes, such as would be typically found in a motor pool full of vehicles all trying to simultaneously exchange information. Since the data communication controller 230 initiates communication with a single vehicle waiting at the pump, the possibility of communication contention is greatly reduced and information download or upload time is thereby reduced.

To optimize the WLAN embodiment described above, the data communications controller 230 may instruct communications element 414 to transmit initial signals at a relatively high power and thus longer range, perhaps providing a range of ten of feet. Once communications with the identified vehicle is established, the data communications controller 230 may then instruct communications element 414 to transmit additional signals, including data signals to or from the vehicle, at a reduced power with a corresponding reduction in range to a few feet and a corresponding reduction in interference. Alternatively, the data communications controller 230 may instruct the communications element 414 to transmit the initial signals using several antennas (one of which may be the antenna associated with communications element 414) to provide for omni-directional or hemispherical coverage. Once communications with the identified

vehicle is established, the data communications controller 230 may then instruct communications element 414 to select a single antenna, for instance the one associated with communications element 414, to transmit the additional signals, including data signals to or from the vehicle.

FIG. 6 illustrates a system 200 for data transfer to or from a vehicle in accordance with an embodiment of the present invention. In this embodiment, the primary service function being performed on the vehicle is refueling. System 200 includes similar elements to those comprising system 200 of FIG. 2. System 200 of FIG. 6 may include a communications network element 240 that resides on a fixed network infrastructure and that is coupled to one or more data repositories, a data communications controller 230, a first communications element (not shown) that may be coupled to a fuel nozzle 224 of a refueling system 220, a second communications element (not shown) that may be coupled to a vehicle 210, and a WLAN access point 250. Similarly to system 200 in FIG.2, system 200 of FIG. 6 functions in accordance with the flow diagram illustrated in FIG. 3 and described above in detail.

To facilitate a more efficient transfer of data the first communications element 130 (FIG. 5) may also communicate to the data communications controller 120 (FIG. 5) vehicle identification information, for instance, received from the second communications element 140 through a communications link 170. Since the vehicle is in a fixed position during the process of refueling, the communication parameters may be optimized in a manner not possible with moving vehicles. By specifically identifying the vehicle being refueled, this method eliminates the possibility of starting a data exchange with a non-optimally-placed vehicle (that happens to be within communication range), thereby with decreasing interference, enhancing in overall system capacity, and minimizing the possibility of missing a vehicle to service. Vehicle identification may be accomplished by reference to FIG. 4 in the following manner.

Communications element 434 that is coupled to the vehicle may be, for instance, in the form of physical markings such as a bar code or may be a passive

component such as an RFID or optical tag device, or an active component such as a radio, an ultrasonic transmitter or a conduction transponder. Correspondingly, communications element 414 that is coupled to the refueling system may be any suitable reader device. Thus, when communications elements 414 and 434 are operatively coupled together, communications element 414 may read the vehicle identification information from communications element 434. At least a portion of this vehicle identification information may then be communicated to the data communications controller 230 via conventional means known in the art.

FIG. 7 illustrates a system 100 in accordance with another embodiment of the present invention, wherein the data communications controller resides in the vehicle. System 100 of FIG. 7 includes elements that are similar to those elements that comprise system 100 in FIG. 1. However the connectivity between the elements illustrated in FIG. 7 and their associated functionality is slightly different from the connectivity and the associated functionality of the elements illustrated in FIG. 1. System 100 of FIG. 7 includes a communications network element 110 that resides on a fixed network infrastructure and that is coupled to one or more data repositories (not shown), a data communications controller 120, a first communications element 130 that is coupled to a system for performing a primary service function on a vehicle, and a second communications element 140 that is coupled to the vehicle. The data communications controller 120 manages the transfer of data between the vehicle and one or more data repositories.

Data transfer to and from the vehicle is enabled using system 100 as follows. Upon detection of the initiation of a primary service function, a communications link 150 is established that enables the transfer of data to or from the vehicle. In one embodiment, the vehicle, or one or more devices in the vehicle, may signal the data communications controller 120 when the primary service function has been initiated. For instance, in the case where the primary service function is refueling, the signal that the fueling process has been initiated may be generated as a function of opening a fuel door on the vehicle, removing a fuel cap, detecting fuel flow, detecting a change in the level of fuel in the

vehicle's fuel tank, etc. In an alternative embodiment, the second communications element 140 may signal to the data communications controller 120 when communications link 150 has been established.

Communications link 150 may be established, for instance, as a function of the operative coupling of the first communications element 130 that is coupled to the primary service function system and the second communications element 140 that is coupled to the vehicle. The data communications controller 120 then manages the transfer of data from the vehicle to communications network element 110, and ultimately to a data repository via the established communications link 150. In the same manner, data may be transferred from the data repository to the vehicle via the established communications link 150. Then upon the termination of the service function and, correspondingly, the communications link 150, or alternatively, upon the completion of the transfer of a predetermined amount of data, the data communications controller 120 manages the termination of the data transfer. Those of ordinary skill in the art will realize that the method for data transfer in accordance with the embodiment of the invention illustrated in the flow diagram illustrated in FIG. 3 can be performed by the system 100 illustrated in FIG. 7.

In an alternative embodiment with respect to system 100 of FIG. 7, wherein the data communications controller resides in the vehicle, the communications link that enables data transfer between the vehicle and the data repository may, alternatively, be established as a function of a WLAN device coupled between the communications network element 110 and the vehicle and having the functionality as described by reference to FIG. 5.

Those of ordinary skill in the art will further realize that the implementation of the present invention is not limited to the servicing of a vehicle but may be applicable to the servicing of other entities such as residences, roadside utility entities, etc. Thus, in another embodiment of the invention, the primary service function system could be mobile and the entity being serviced could be fixed or semi-permanently located. Such an embodiment would enable

the transfer of information such as license plate numbers captured by roadside radar displays while they are being refueled or the upload of usage data from rural homes when an associated liquid petroleum gas or water tank is being refilled or waste is being removed from the septic system.

While the invention has been described in conjunction with specific embodiments thereof, additional advantages and modifications will readily occur to those skilled in the art. The invention, in its broader aspects, is therefore not limited to the specific details, representative apparatus, and illustrative examples shown and described. Various alterations, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. For instance, the present invention may be implemented in conjunction with any type of vehicle including, but not limited to, cars, boats, helicopters, motorcycles, etc. that require some form of periodic servicing. The invention may also include other means of coupling communications elements such as acoustic coupling. Thus, it should be understood that the invention is not limited by the foregoing description, but embraces all such alterations, modifications and variations in accordance with the spirit and scope of the appended claims.